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MORE THAN FEAR INDUCTION: TOWARD AN UNDERSTANDING OF PEOPLE'S MOTIVATION TO BE WELL-PREPARED FOR EMERGENCIES IN FLOOD PRONE AREAS

Joop de Boer[*1]), W. J. Wouter Botzen[1]), Teun Terpstra[2])

[1]) Institute for Environmental Studies, VU University Amsterdam

[2]) HKV Consultants, Lelystad

[*] Address for correspondence:
Joop de Boer PhD
Institute for Environmental Studies
VU University Amsterdam
De Boelelaan 1087
1081 HV Amsterdam
The Netherlands
E-mail: joop.de.boer@vu.nl
Fax: +31 20 5989553
Phone: +31 20 5989555

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ABSTRACT

The present paper examines the extent and manner to which evaluations of flood-related precautions are affected by an individual's motivation and perception of context. It argues that the relationship between risk perception and flood risk preparedness can be fruitfully specified in terms of vulnerability and efficacy, if these concepts are put into the perspective of prevention-focused motivation. This relationship was empirically examined in a risk communication experiment in a delta area of the Netherlands (n = 1,887). Prevention-focused motivation was induced by contextualized risk information. The results showed that prevention focused individuals were more sensitive to the relevance of potential precautions for satisfying their needs in the context they found themselves in. The needs included, but were not be limited to, fear reduction. Due to the heterogeneity of the residents, the evaluations reflected individual differences in the intensity and the selectivity of precautionary processes. Four types of persons could be distinguished according to their evaluation of precautionary measures: a high scoring minority, two more selective types and a low scoring minority. For policy-makers and risk communicators it is vital to consider the nature of prevention motivation and the context in which it is likely to be high.

KEY WORDS

risk communication, prevention motivation, vulnerability, efficacy, precautions

Highlights

- Addresses the links between risk perception and precautionary processes.
- Uses the concepts of vulnerability, efficacy, and prevention-focused motivation.
- Describes a risk communication experiment among residents of a delta area.
- Dependent measures are evaluations of precautions by the residents.
- The results show differences in intensity and selectivity of the responses.

1. INTRODUCTION

The increasing urbanization of river delta areas and coastal zones in combination with future climate change will result in rising numbers of people who have to cope with the risk of flooding.[1] These areas are particularly vulnerable because climate change will lead to a rise in sea level and to an increase in the probability of high river discharges.[2] Communicating the risks to the public is important for better risk awareness and improved disaster preparedness, but it is a challenging task as the links between risk perception and flood risk preparedness are not always clear.[3-6] Also, it is known that the main factor to stimulate preparedness is direct experience with previous flood hazards,[7-11] but a crucial aspect of the current challenge is that the residents who have to be informed often lack that experience.[12,13] The approach taken here builds on Rogers's Protection Motivation Theory (PMT),[14,15] Lindell and Perry's Protective Action Decision Model (PADM),[3,16] and Higgins's Regulatory Focus Theory (RFT).[17-19] PMT and PADM are particularly useful in identifying the ways in which disaster experience influences preparedness behavior. The main point of the present paper is that RFT adds important motivational principles to PMT and PADM, which are especially relevant for appealing to residents who have no disaster experience. The work is based on a risk communication experiment carried out in the Rotterdam area of the Netherlands and described in two papers. Our earlier reported findings[20] focused on the ways in which the participants gave motivational significance to the likelihood of a disaster. The present paper examines their evaluations of flood-related precautions and addresses the extent and manner to which these evaluations are affected by motivation and perception of context, a topic that has hardly been addressed in the empirical literature.[21]

The Rotterdam area is located at the mouth of the river Rhine and the river Meuse, near the North Sea coast. An overload of surface water due to extreme weather events can cause overland flooding and in house flooding in the whole or part of the area. The location is particularly suitable for the experiment, because the authorities are developing plans to make the delta more "climate proof".[22] Climate proofing aims to reduce the risks of flooding by "hard" infrastructure and "softer" measures, such as insurance schemes or evacuation plans, which require effective communication with the residents. The latter, however, are unaware of geographic variations in the occurrence and potential impact of flood risks.[23] These geographic variations are largely a result of differences in the development of dikes and polders. Polders are low-lying areas of reclaimed land (up to 7 meters below sea level), which are protected by dikes, designed to withstand water levels that occur with frequencies of 1/10,000 per year or 1/4,000 per year. Along the river there are also city areas outside the dikes, such as redeveloped harbor areas, which are to a certain extent safeguarded against flooding due to their elevation above sea level (about 3 meters). These areas and several deep polders are an important focus of climate proofing.

The aim of the study was to support policy makers who were looking for advice on communication with the residents on the relevance of flood risk preparedness. One of the concerns of policy makers was how the residents would respond to differences in flood risks associated with living outside the dikes and in a deep polder. Another point was whether the communication strategy should highlight the risks (e.g. particularly the

uncertain effects of future climate change) or flood control (e.g. the commitment of the authorities to provide flood safety). Also, there was the question of whether it would be meaningful to emphasize the efficacy of precautions. In designing an experiment to address these issues, we were not in the position to inform the residents about flood risks associated with their own dwellings. Therefore, we investigated the responses of a sample of residents to descriptions of particular living conditions, which were realistically framed in terms of flood frequency and depth. These responses could be compared with those of a control group who responded to the questions with their own situation in mind.

The paper is structured as follows. Section 2 describes the motivational principles that RFT adds to PMT and PADM, and introduces the research questions. Section 3 reports the questionnaire survey, including its experimental design, and the measures employed in this study. The results are described and analyzed in Section 4. Section 5 discusses the implications of this study and Section 6 gives the conclusions.

2. THEORETICAL BACKGROUND

2.1 Motivational principles

PMT and PADM are frameworks that were originally developed to explain the effects of fear appeals on behavior change and afterwards elaborated into a decision model of alternative protective actions. The key elements are risk perception and beliefs about the characteristics of protective actions. Risk perception has three logically distinct, though overlapping, aspects: a sense of vulnerability to a threatening event, likelihood of being harmed by the event, and extent of harm the event would cause.[24,25] Crucial beliefs

about protective actions refer to an appraisal of their desired effects (response efficacy) and their costs (response costs), plus one's perceived ability to perform the action (self-efficacy).[10,26,27] Depending on the particular situation, additional variables may play a role, such as time interval in which the event will occur, watching others prepare and learning from each other's successes.[28] Although the links between risk perception and preparedness behavior may not always be clear in field settings,[4,29] the basic prediction of the decision model has been confirmed in several meta-analyses of fear-arousing communications: it is primarily the combination of high (perceived) vulnerability and high (perceived) efficacy that determines the adoption of protective actions, provided that the (perceived) costs are sufficiently low.[24,30,31]

The ways in which preparedness behavior is influenced by disaster experience are directly or indirectly related to levels of vulnerability and efficacy.[25] For instance, personal experience of harm may be explained by a lack of precautions, which can lead to fear of its recurrence and actions to change the situation. This fits well within PMT and PADM. Apart from the role of disaster experience and fear, however, preparedness behavior may be influenced by socialization experiences, as all people have, to a certain degree, been socialized to be concerned with safety and responsibility. What children learn about self-regulation varies when their interactions with caretakers appeal, in terms of Higgins's RFT, to either their prevention or their promotion system.[17,32] The prevention system underlies vigilant concerns about safety and fulfillment of responsibilities. In contrast, the promotion system underlies a person's eager concerns with the pleasurable presence of positive outcomes, including accomplishments and

aspirations. Whether a person is likely to be more focused on prevention or on promotion depends on temporary and permanent factors.[18,33] Although individuals may be chronically more prevention- or promotion-oriented, their momentary focus can also be affected by the situation. This makes it important to examine how situations can be framed in such a way that either prevention or promotion aspects are highlighted.[34] Hence, RFT provides a number of insights that can be extremely useful to frame risk information coherently.[20]

A crucial point is that people's focus on promotion or prevention goals moderates both the quality and the intensity of their evaluative sensitivities to objects and events in the world. When people are prevention focused, they are sensitive to and guided by safety, security, and protection needs, which they may otherwise neglect. Moreover, a fitting combination of goal orientation and strategies to reach the goal, such as vigilant checking of the environment, may give people the experience of "feeling right" about what they are doing.[17-19] This experience adds to their motivation and intensifies their responses to the objects they are evaluating. A strategy that fits very well with prevention goals is defensive pessimism,[18] a form of negative thinking that allows a person to prepare for potentially dangerous situations by imagining the worst possible outcome and taking steps to avoid it. People may pessimistically believe that they will not succeed in obtaining security unless they carry out some specific activities now. The process often involves beliefs about what one "ought" to do under given circumstances, such as responsibilities and duties of ownership.[17-19] Although the relevance of these beliefs has

been noticed in the literature on disaster preparedness,[35-37] this literature does not go into the specific nature of prevention-focused motivation.

RFT also adds a new level of understanding to the "protective action decision process" block in the PADM.[3,16] Promotion- and prevention-focused people prefer different ways of decision making in terms of either selecting or eliminating options from a choice set. An individual who makes a decision with a promotion focus tends to select the best alternative in a choice set, which agrees with the literature on expectancy-value models of motivation.[17-19] This model also coincides with the decision block in the PADM, which considers the perceived benefits and costs of potential precautions. However, making a decision with a prevention focus often entails vigilantly checking whether each of the available options may be necessary to ensure safety.[38] Before eliminating the options that are unnecessary, these individuals want to insure that they do not reject an option too quickly, which is a less selective strategy. Indeed, although not based on RFT, a recent study suggests that a heterogeneous group of flood zone residents can be divided into various "action types", which differ in terms of both the intensity and the selectivity of preparatory processes, indicating that a high intensity of motivation goes together with intentions for a broader range of protective actions than a moderate intensity of motivation, which is associated with more selective intentions.[39]

2.2 The present paper

The present paper examines evaluations of flood-related precautions by analyzing people's responses to different risk frames. Frames are mental knowledge structures that

capture the typical features of an event to promote a coherent understanding[40,41] and a risk frame[42] is a frame in which the notions of chance and harm are woven into a story about specific events (e.g. extreme weather) that are conceptually linked to an unwelcome outcome (e.g. a flood). Based on RFT, the overall expectation was (1) that the risk frames would induce a prevention focus in individuals, which would be higher among those with a chronic prevention orientation, and (2) that prevention focused individuals would be more sensitive to the relevance of potential precautions for satisfying their needs in the context they find themselves in. The needs may include, but need not be limited to, fear reduction. Both parts of this expectation were examined in the experiment; the first part was tested in our earlier paper,[20] which is summarized below—the second part is addressed here.

The first part of the experiment was meant to provide a context and induce a prevention focus. The attention of the participants in the framed groups was focused on a risk frame, which described a neighborhood potentially affected by (a) floor flooding outside the dikes (a 1 in 10 year probability of flooding with limited depth of inundation) or (b) deep flooding in a deep polder (a 1 in 2000 year probability of flooding with high depth of inundation). The communication context either (a) highlighted the risks or (b) highlighted flood control. The groups were asked to respond to the questions as if they themselves lived in the described neighborhood. The control group was asked to respond with their own situation in mind. The questions were meant to measure situationally induced, prevention-focused and promotion-focused responses to the situations. A separate set of items was used to measure the participants' chronic prevention- or promotion-focused

orientations. The results revealed large differences in situationally induced, prevention-focused responses between the framed groups and the control group (more than 1 *SD* higher). In line with RFT, there was a significant interaction effect of the risk frames with chronic prevention orientation; flood risk communication framed to induce a prevention focus was more likely to have an effect on chronically prevention-focused participants than on others.

The second part of the experiment concerned the impacts of the same variables, plus the additional variables described below, on the evaluation of flood-related precautions. The level of prevention motivation may act as a general motivational factor in the evaluation measures. Additionally, the risk frames used to induce prevention motivation may work to specify the context in which the precautions can be applied, i.e. to cope with floor flooding outside the dikes or deep flooding in a deep polder. This situational context could make particular precautions, such as buying sandbags, more relevant to the person's needs. To explore whether it would be meaningful to emphasize the efficacy of precautions in such a context, a brief general statement on the efficacy of precautions in mitigating flood damage was presented (or not presented) as an additional between-subject variable.

In order to investigate differences in the intensity and the selectivity of preparatory processes, a variety of precautions was chosen. They were not meant to be exhaustive, but rather to point out some of the options. The precautions were (a) putting together an emergency kit, (b) searching for water level information on specialized websites, (c)

buying sandbags for one's home, and (d) tiling the floor of one's home (described as flood resistant flooring). Each precaution was evaluated in terms of different aspects of efficacy and supposed necessity, as described in the literature,[10,27] including response efficacy, self-efficacy, and intention of use.

In addition to the expected role of prevention motivation, a number of other variables were taken into account, because they may help to better understand the intensity and the selectivity of preparatory processes. Although the provided risk information was not meant as a "fear appeal",[15] a measure of negative affect was included to control the degree of fear inducement created by the frames. This measure was adapted from earlier work of Terpstra.[12] It should be noted that some of the items meant to measure prevention-focused responses also refer to affect (i.e. becoming agitated) and that these concepts are logically related.[17] Measures of positive affect and promotion-focused motivation were included to control the potential role of optimistic bias.[25,43] As the inhabitants of the Netherlands may feel that they can rely on the existing system of flood management, without any intentions to act themselves,[12,43] a measure of trust was developed focusing on those aspects of the trust concept that capture trust in competent risk management by the authorities. Although trust entails more dimensions,[44] this approach was deemed to be the most relevant for this study. Another topic is that communicating flood risk may seriously be complicated by opposing views on the seriousness of climate change.[45,46] To assess the main views, some items were adapted from earlier work on skepticism about climate change in general,[47] complemented by

items on specific climate change risks at the local level. Finally, gender, age and level of education were included to control for associations with background variables.

The research questions were the following: (1) How do the evaluations of the precautions differ between the control and the framed groups before and after controlling for the differences in prevention motivation? (2) How are the evaluations of the precautions affected by the three contextual variables (outside the dikes or in a deep polder, highlighted risks or flood control measures, efficacy statement or no statement) before and after controlling for the differences in prevention motivation? (3) Can the evaluations of the precautions be used to identify different types of participants in the framed groups according to the intensity and selectivity of their preparatory processes? (4) How different are these types of participants in terms of the risk frames they were exposed to, their gender, age, level of education, prevention or promotion motivation, negative or positive affect, trust in competent risk management, and beliefs about climate change?

3. METHOD

3.1 Design

The experiment was conducted using questionnaires in which the participants were asked to respond to descriptions of particular living conditions (i.e. framed groups) or their own living conditions (i.e. control group). The framed groups were different on three between-subject variables (focal context, communication context and efficacy statement), based on a design presented in Table I. The study also included an extra comparison group who

answered questions about living in a “water city project”, but this group was not used in the present paper as they faced a different set of opportunities.

TABLE I

3.2 Subjects and procedure

Data were collected in a survey among residents with Internet access (includes more than 90% of the population in the Netherlands). The sample was randomly drawn from a large panel of persons in the Rotterdam area who are willing to participate in web-based research for a small reward, which they can keep for themselves or donate to charity. In June 2011, the questionnaires were completed by 1,887 participants (2,302 participants including the extra group not used here, response rate 69%) who had been randomly divided into 8 experimental groups and one control group, each of about 200. All the participants met the following criteria: they were in the age of 25 until 75, were head of household, or the spouse/partner of the head of household, and therefore potentially responsible for the safety of themselves and any other members of their household. The data showed a representative distribution of the main demographic characteristics, although young males, low-income renters, and people from ethnic minorities were slightly underrepresented in comparison with a prior survey.[48] The demographic characteristics did not differ between the conditions (all p’s > .05).

The framed groups and the control group received versions of the questionnaire that shared the same structure, introduced by a brief description of its topic (“living near

major rivers"). The next part focused the attention of the framed groups on one out of four risk frames with context descriptions. The control group responded to the questions based on their own situation. The first four sets of questions measured prevention- and promotion-focused responses to the frames, positive and negative affect, trust in competent risk management by the authorities, and monetary valuation of insurance against flood risk (the latter is reported in a separate paper).[49] Then the topic of flood damage precaution was introduced. Half of the participants in the framed groups received a statement on the efficacy of precautions in mitigating flood damage. This was followed by four sets of questions that measured evaluations of the precautions, chronic prevention and promotion motivation, beliefs about global and local impacts of climate change, and socioeconomic variables. All of the items were measured on 7 point scales. The questionnaire had been subjected to a qualitative pretest and a pilot study (n = 120) to check how well the descriptions and the questions were understood.

3.3 Experimental conditions

Each experimental condition was based on a risk frame, which contained factual information provided by local experts. Full descriptions of the frames are given in the Supplementary Material. Frames 1 and 2 were stories about living in a neighborhood outside the dikes, such as a redeveloped harbor area, which is elevated above sea level, but where floods (water nuisance) can occur that potentially cause damage. Both frames used the same risk information but the additional message varied. The risk information described "(…) the combined effect of large amounts of water in the rivers and a storm surge of seawater (during a Northwestern wind), which causes high water levels in the

delta. This hazard has decreased because of the Maeslant (storm surge) Barrier, but has not been completely eliminated. During times of high water levels streets can be covered with water. Such high water levels occur on average once in 10 years."

Additionally, Frame 1 highlighted the risks with four pictures of floor floods and a statement about the uncertain impacts of climate change, which may increase the flood risk outside the dikes in the future. Instead of highlighting the risks, Frame 2 provided neutral pictures of neighborhoods outside the dikes and a statement about how the Dutch government continuously works on flood safety and protection against the water in the far future (until the year 2100).

Frames 3 and 4 were stories about living in a deep polder near the river, which mentioned that it is increasingly common that such houses are built at a depth of 5 or 6 meters below the water level of a river. Both frames used the same risk information but the additional message varied. The risk information described "(…) the combined effect of large amounts of water in the rivers and a storm surge of seawater (during a Northwestern wind), which causes high water levels in the delta. This hazard has decreased because of the Maeslant (storm surge) Barrier, but has not been completely eliminated. Dikes can breach if water levels in the river are very high. Such high water levels occur on average once in 2000 years. But, a dangerous situation can also arise if water levels are lower. That is because not all dikes are exactly equally strong. Even though the probability is low, the water level in the polder after a dike breach can rise up to 2 to 3 meters high."

Additionally, Frame 3 highlighted the risks with four pictures of deep floods and a statement about the uncertain impacts of climate change, which may increase the flood risk in deep polders in the future. Frame 4 provided pictures of hard infrastructure for flood protection and a statement about how the Dutch government continuously works on flood safety and protection against the water in the far future (until the year 2100).

In the second part of the experiment, the information was complemented by a reminder of the flood risk and every inhabitant's responsibility to prevent flood damage to their property. Half of the participants of the framed groups received a statement that was attributed to the International Commission for the Protection of the Rhine,[50] in which the Netherlands participates. It said that the commission's study of flood damage showed that citizens can reduce property damage up to 80% by taking precautions themselves.

3.4 Measures

3.4.1 Situationally induced prevention- and promotion-focused responses

The 7 questions that asked for responses to the risk frames measured prevention focused defensive pessimism (e.g. "If I lived in a neighborhood outside the dikes, then I would make sure that I am well prepared for high water levels") and promotion focused optimism (e.g. "I think that my house would be very attractive because of the water abundant environment"). The control group answered slightly differently worded questions ("As inhabitant of this river delta, I want to make sure that I am well prepared for high water levels"). A principal component analysis with varimax rotation produced the expected two principal components (see Table II). The prevention-focused

component (4 items, Cronbach's alpha = .83) was based on high internal correlations between items on worry and vulnerability. The promotion-focused component (3 items, Cronbach's alpha = . 65) was less strong. It should be noted that this study gave relatively less attention to promotion motivation, because prevention motivation may be of primary importance for flood risk communication.

TABLE II

3.4.2 Positive and negative affect

A set of 8 questions measured positive affect (e.g. "The idea of living in a neighborhood outside the embanked area gives me a happy feeling) and negative affect (e.g. "() gives me an anxious feeling"). Principal component analysis was used to examine positive and negative affect; an oblique rotation (Promax) was chosen as the components may be related to each other. The analysis produced the expected two principal components (see Table III), positive affect (4 items, Cronbach's alpha = .96) and negative affect (4 items, Cronbach's alpha = .95), which were negatively correlated (r = -.46, p < .001).

TABLE III

3.4.3 Trust in competent risk management by the authorities

A set of 5 questions measured trust in competent risk management by the authorities (e.g. "To what extent do you trust that authorities such as municipalities and water boards will be able to ensure that it will be safe for you (and your family) to live in a neighborhood

outside the dikes?"). The measure (see Table IV) was highly reliable (5 items, Cronbach's alpha = .93).

TABLE IV

3.4.4 Chronic prevention and promotion orientations

Chronic motivational orientation was measured by ratings of short portraits, a method adapted from Schwartz.[51] Each portrait consists of two sentences describing a person in terms of a value or preference that is important to him or her. Based on RFT,[20] we assumed that participants have a chronic prevention focus if they prefer security, safety, stability or obeying rules. They have a chronic promotion focus if they prefer portraits of persons who are self-determined, achievement oriented, and open to change. The participants were asked to compare the portrait to themselves and to rate "how much like you" the person is. A principal component analysis with varimax rotation produced the expected two principal components (see Table V), i.e. a prevention-focused component (4 items, Cronbach's alpha = .74) and a promotion-focused component (5 items, Cronbach's alpha = .62).

TABLE V

3.4.5 Skepticism about climate change and awareness of local climate impacts

A set of 6 items measured general beliefs about climate change and specific beliefs about climate change risks at the local level. Principal component analysis was used to examine

the general and specific beliefs; an oblique rotation (Promax) was chosen because the components might be related to each other. The analysis produced the expected two principal components (see Table VI), i.e. skepticism about climate change (3 items, Cronbach's alpha = .74) and awareness of local climate impacts (3 items, Cronbach's alpha = .68), which correlated negatively (r = -.34, p < .001).

TABLE VI

3.4.6 Evaluations of the precautions

The 4 precautions were presented in random order, each with a brief explanation and an accompanying illustration. They were (a) putting together an emergency kit (food and water, first aid kit, portable radio, etc.), (b) searching for water level information on specialized websites, (c) buying sandbags for one's home, and (d) tiling the floor of one's home. Each precaution was put in context (e.g. "If you lived in a neighborhood outside the dikes, what would be your opinion about putting together an emergency kit?") and evaluated as a statement ("seems to me an effective way to increase my safety if there's a flood"). The 7-point scale ranged from completely disagree to completely agree. The criteria were meant to be applicable to evaluations from a cost-benefit perspective (i.e. effectiveness and efficiency) and a broader prevention perspective (i.e. necessity). The items referred to the precaution's effectiveness for safety and for the mitigation of damage, its efficiency for flood control, whether it is troublesome to apply, whether its usefulness is hard to judge, whether it is necessary, and whether one has the intention to

use it. For the analysis, all the evaluations were coded such that a higher score denoted a more positive evaluation.

3.5 Statistical analysis

With regard to the explanatory variables, principal component analysis was applied to check the expected components and to calculate scores for each participant, using the regression method ($M = 0$, $SD = 1$). These scores were used for all subsequent analyses. To address the first and the second research question, repeated measures MANOVA was used to determine the magnitude of both within-subjects (4 precautions, 7 criteria,) and between-subject (control and framed groups) main effects and interactions. The most relevant interactions are the evaluation profiles of the criteria ratings for each precaution (i.e. profile analysis).[52] These analyses were done with and without the two covariates situationally induced and chronic prevention orientations. In line with the other research questions, all the subsequent analyses were done on the framed groups only. A multiple step approach was applied to examine whether the evaluations could be used to identify different types of participants. First, the inter-item correlations between the evaluations were calculated for the development of a scale to assess the perceived relevance of each precaution (the average of the items on effectiveness for safety, effectiveness for mitigation, efficiency for flood control, necessity and intended use). Second, a cluster analysis was carried out on the four scales to identify homogeneous groups of participants based on their evaluations. The hierarchical Ward-approach with a squared Euclidian distance measure was employed to determine the desired number of clusters. Although there are no hard rules for determining the number of clusters, inspection of the

agglomeration schedule revealed a sudden jump in the distance coefficient between four and three clusters, which indicates that four clusters is the best choice. Additionally, K-means cluster analysis was used to segment participants into four distinct clusters or types according to their evaluations. Differences between clusters were substantiated by discriminant analysis. To find out how the four clusters were related to the experimental and the subject variables, the differences in the mean scores of the clusters on the experimental and the other variables were compared for significant differences. One-way ANOVAs with Bonferroni's post hoc test were used for interval data; chi square for categorical data. Using a multivariate approach, multinomial logistic regression was performed to predict the types as a function of the experimental and the subject variables. Finally, correlations were calculated between the main variables. All analyses were conducted with SPSS 20 for Windows.

4. RESULTS

The first research question considered the role of the risk frames in the evaluation of precautions. Table VII provides an overview of the evaluations by the control and the framed groups. The MANOVA showed that the four precautions received different ratings (η^2_p= .113, p < .001), that the ratings varied on the seven criteria (η^2_p= .200, p < .001) and that the profile of the criteria ratings varied across the precautions (two-way interaction, η^2_p= .326, p < .001). The ratings were on average higher among the framed groups (η^2_p= .037, p < .001), but the differences depended on the criteria (two-way interaction, η^2_p= .110, p < .001) and varied slightly across the profiles per precaution (three-way interaction, η^2_p= .018, p < .05). Table VII reveals that several evaluations

were relatively strongly affected by the risk frames but others were not. The most discriminating criteria were related to the perceived response efficacy, necessity and intended use of the precautions. The criteria that were meant to reflect potential differences in self-efficacy (whether the precaution is troublesome to apply and whether its usefulness is hard to judge) were not affected by the risk frames. After controlling for prevention motivation, it was found that the ratings were only slightly higher among the framed groups (η^2_p= .003, $p < .05$), that the evaluation profile of the precautions of the control group was more comparable to that of the framed groups, although still dissimilar (two-way interaction, η^2_p= .032, $p < .001$), with slight differences across the profiles per precaution (three-way interaction, η^2_p= .016, $p < .05$). Hence, the inclusion of the two measures of prevention motivation, which both correlated with the most discriminating criteria, explained a large part but not all of the differences between the control and framed groups.

TABLE VII

The second research question was how the evaluations of the precautions were affected by the three contextual variables (outside the dikes or in a deep polder, highlighted risks or flood control measures, statement on efficacy or no statement). Again the MANOVA (framed groups only) showed that the four precautions received different ratings (η^2_p= .285, $p < .001$), that the ratings varied on the seven criteria (η^2_p= .541, $p < .001$) and that the profile of the criteria ratings varied across the precautions (two-way interaction, η^2_p= .558, $p < .001$). The ratings were on average slightly higher in the outside the dikes

condition (η^2_p= .014, p < .001) and the highlighted risks condition (η^2_p= .007, p < .01). These small main effects were not homogeneous. The outside the dikes groups evaluated the precautions differently (two-way interaction, η^2_p= .010, p < .01), rated the criteria differently (two-way interaction, η^2_p= .069, p < .001), and showed different profiles per precaution (three-way interaction, η^2_p= .070, p < .001). Table VII reveals that, overall, putting together an emergency kit had low means, searching for water level information had the highest means. The outside the dikes groups gave higher ratings to buying sandbags, tiling floors and searching for water level information, in particular regarding the response efficacy, necessity and intended use of these precautions. More specifically, in comparison with tiling the floor, buying sandbags was considered less effective for mitigation but more effective for safety. The other results revealed several significant but small interactions involving the highlighted risks condition and the efficacy statement condition. For instance, the efficacy statement led to slightly higher ratings of the response efficacy of buying sandbags in the outside the dikes condition (four-way interaction, η^2_p= .021, p < .01). Importantly, the impacts of the contextual variables were generally not affected by the inclusion of the covariates.

The third research question was whether the evaluations could be used to identify different types of participants according to the intensity and selectivity of their preparatory processes. For this analysis, four scales were constructed to assess the perceived relevance of each precaution. Each of the four scales was based on 5 items (effectiveness for safety, effectiveness for mitigation, efficiency for flood control, necessity, intention to apply), which yielded reliable measures. Cronbach's alphas were

.79 (emergency kit), .76 (water level information), .84 (buying sandbags) and .74 (tiling the floor). The results of the hierarchical cluster analysis with the four scales as clustering variables suggested a four cluster solution that was theoretically meaningful. Table VIII presents the means of the four clusters on the four scales. Cluster 1 (all low, 23% of the participants) was relatively low on all the four scales; cluster 2 (medium—no sandbags, 27%) was medium on three scales, but low on buying sandbags; cluster 3 (medium—no kit, 28%) was medium on three scales, but low on the emergency kit; and cluster 4 (all high, 22%) contains participants who were high on all the four scales. A linear discriminant function used to classify the participants into the four clusters showed that 97.8% was correctly classified. Hence, the four types of participants differed in the intensity and selectivity of their preparatory processes.

TABLE VIII

The fourth research question was how similar or different the types are in terms of the risk frames they were exposed to, their gender, age, level of education, prevention or promotion motivation, negative or positive affect, trust in competent risk management, and beliefs about climate change. Table IX displays how the clusters were related to these variables. The effects of the three contextual variables were significant but small; participants in the outside the dikes condition, the highlighted risks condition, and the efficacy statement condition were more likely to belong to cluster 4 (all high). The multinomial logistic regression analysis revealed that the contributions of the factors to

the overall model (not shown) were consistent with the significance levels in Table IX; the model had a Nagelkerke pseudo R^2 of .034 (Chi- square = 54.4, df = 9, $p < .001$).

Table IX also shows how the clusters were related to gender, age and level of education. Gender did not make a significant difference, but age and education did. Persons older than 55 years were overrepresented in cluster 4 (all high) and underrepresented in cluster 1 (all low). More persons with a higher level of education were included in cluster 3 (medium—no kit) and cluster 1 (all low). With regard to the other subject variables, a number of considerable differences between the clusters were found (see Table IX). In comparison with cluster 1 (all low), the participants of cluster 4 (all high) had much higher scores on chronic prevention, situationally induced prevention, and awareness of local climate impacts; they had moderately higher scores on negative affect and slightly higher scores on chronic promotion and trust in competent risk management by the authorities. There were no significant differences in situationally induced promotion, skepticism about climate change and positive affect. The multinomial logistic regression analysis revealed that the contributions of the experimental and the subject variables to the overall model (not shown) were consistent with the significance levels in Table IX; the model had a Nagelkerke pseudo R^2 of .305 (Chi- square = 567, df = 45, $p < .001$). Hence, the differences between the four types of participants were found to be dominated by differences in prevention motivation, although other variables were also significant.

TABLE IX

To check the results, Table X shows the correlations between and means and SDs of the variables in the framed groups. Again it appears that chronic prevention and situationally induced prevention had the largest correlations with the perceived relevance of the four precautions and in particular with the evaluation of searching for water level information (r = .40 and r = .35). The latter correlations illustrate the inherent importance of vigilance for prevention motivation. The correlations between negative affect and situationally induced prevention (r = .47) as well as chronic prevention (r = .34) can be attributed to the logical relation between these concepts. Importantly, negative affect had only small correlations with the perceived relevance of the four precautions (r ranged from .13 to .16). Hence, negative affect played a minor role in the action-oriented preparatory processes. Awareness of local climate impacts was weakly correlated with the perceived relevance of the four precautions (r ranged from .19 to .27). It may be noted that the correlations presented in Table X would hardly change if the four scales on the relevance of the precautions were replaced by the single items regarding their intended use (e.g. the correlations of chronic prevention and situationally induced prevention with searching for water level information changed from r = .40 and r = .35 into r = .37 and r = .35). Table X also provides some information on the measures of promotion motivation. Both situationally induced and chronic promotion were moderately positively correlated with trust in competent risk management by the authorities (r = .40 and r = .25) and positive affect (r = .53 and r = .30), but negatively with negative affect (r = -.41 and r = -.22). Similarly, trust in competent risk management by the authorities was positively correlated with positive affect but negatively with negative affect (r = .43 and r = -.35). Again, it appears that the positive or optimistic responses were essentially independent of the

evaluations of the precautions, which agrees with the distinct orientations of promotion and prevention motivation.

TABLE X

5. DISCUSSION

This paper has focused on the extent and manner to which evaluations of potential precautions were affected by motivation and perception of context. Our results for research question 1 demonstrated that the evaluations of the precautions differed significantly between the control and the framed groups and that the risk frames led to more positive evaluations. The differences were seen most clearly in terms of perceived response efficacy, necessity and intended use. These most discriminating criteria correlated with both situationally induced and chronic prevention orientation. The inclusion of these two covariates explained a large part but not all of the differences between the control and framed groups. As indicated by our results pertaining to research question 2, perception of context also played a role. Among the participants in the framed groups, the evaluations of the precautions were partly dependent on the three contextual variables, of which the outside the dikes versus deep polder condition had the largest impact. Although often small in size, the impacts of these variables were generally not affected by the inclusion of the covariates. This reflects the unique contribution of the contextual variables to the action-oriented preparatory process.

Through our results of research question 3, we identified four different types of participants in the framed groups according to the intensity and selectivity of their preparatory process. A minority of the participants scored low on all the four scales for the perceived relevance of the precautions. Two other types of participants were medium on three scales and low on one, because they had no positive evaluation of either the emergency kit or the sandbags. Another minority were high on all the four scales. Our results relating to research question 4 showed that the differences between the high and low scoring types of participants were strongly associated with both chronic and situationally induced prevention motivation. These associations were much stronger than those with negative affect (i.e. fear), which seemed to have played a minor role in the action-oriented preparatory processes.

These results contribute to a better understanding of the relationship between risk perception and flood risk preparedness, which can be specified in terms of (perceived) vulnerability and efficacy. A sense of vulnerability—or what natural hazards researchers call personal risk[28]—is an important aspect of risk perception,[24,25] and our results show that this is not just a matter of fear. Vulnerability to prevention needs may be triggered by concerns about safety, security, and protection, which may be related to responsibilities and moral duties. In comparison with the control group, the framed groups showed a much higher prevention orientation, including a sense of vulnerability, due to their exposure to contextualized risk information. This was reflected by positive evaluations of the precautions. The evaluation profile of the highly motivated type of participants may be explained by their focus and their rule of decision-making (insuring not to reject an

option too quickly) together with defensive pessimism. Other participants demonstrated a more selective approach and viewed the emergency kit or the sandbags as less relevant to their needs. It was also observed that some brief, realistic statements that highlighted vulnerabilities and response efficacy had small effects on the perceived relevance of the precautions. Hence, the results underline the crucial role of the combination of high vulnerability and high efficacy in the adoption of protective actions,[24,30,31] and put it into the broader perspective of prevention motivation.

The role of several other variables appeared to be small. A key feature of our approach was that all the information presented in the risk frames was based on realistic figures. The realistic approach may explain why the differences between the responses to the four risk frames were relatively small. Measures of promotion-focused motivation and positive affect did not indicate that the evaluations of the precautions were systematically affected by an optimistic bias. An explanation may be that the risk frames did not provide information that would threaten a person's desire to hold and maintain attitudes that have positive implications for the self,[53] for example, by suggesting that he or she has chosen the wrong place to live. Instead, the information was relevant for the participants' goals and did not necessarily have negative implications for their self-views. The measure of trust in competent risk management was included because Dutch citizens tend to believe they can rely on the status quo, which makes flood precautions seem less relevant.[12] In the present study, however, there were no indications that participants with a high level of this kind of trust did not take the risk frames seriously. As expected, there were opposing views on the seriousness of climate change and a distinction could be made between

general beliefs and place-based beliefs about climate change risks. Prevention motivation and awareness of local climate impacts tended to support each other (i.e. there was a small experimental effect and correlational evidence). An important reason for this might have been that climate change was not addressed in isolation but as part of an uncertain future of the neighborhood.[54] Hence, it is crucial to frame risk information in a way that does not have negative implications for people's self-views.

For policy-makers and risk communicators it is important to consider the nature of prevention motivation and the context in which it is likely to be high. One of the points to take into account is that having a situationally induced prevention focus is, by definition, often a temporary state. Risk communicators can use the attentional focusing effect of a prevention frame to create such a situation from time to time and then take as much advantage of it as possible to involve their target group. This strategy requires well-designed communications that tailor context-independent notions of precautions (e.g. sandbags in general) to the particular context in which people need to think about it (e.g. sandbags placed in the right locations). Another strategy is that risk communicators further develop duties and responsibilities for community members, which can trigger their vulnerability to prevention needs in the case of a potential emergency. This strategy is consistent with studies that emphasize the importance of community participation and social influences in the preparedness process.[6,35,55] Prevention motivation can very well be a group experience. As prevention and promotion are distinct orientations, both may be relevant for disaster preparedness in their own way. An interesting option to consider is that the steps necessary for disaster preparedness may be divided into prevention-

related aspects, such as buying sandbags, and promotion-related aspects, such as investing in measures that increase property values. This topic requires further research, which may be of considerable value for the development of new strategies for disaster preparedness.

6. CONCLUSION

The relationship between risk perception and flood risk preparedness can be fruitfully specified in terms of (perceived) vulnerability and efficacy, if these key concepts are put into the broader perspective of prevention-focused motivation. A sense of vulnerability is an important aspect of risk perception and is closely connected with prevention focused motivation. This motivation tends to increase people's sensitivity to the relevance of potential precautions in the context they find themselves in. This process led to positive evaluations of the relevance of a number of flood-related precautions. Due to the heterogeneity of the residents, the evaluations also reflected individual differences in the intensity and the selectivity of precautionary processes. Negative affect (i.e. fear) seemed to have played a minor role in the action-oriented preparatory processes. Hence, for policy-makers and risk communicators it is vital to consider the nature of prevention motivation and the context in which it is likely to be high.

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Table I

Experimental design.

Conditions	Randomized groups								
	1	2	3	4	5	6	7	8	9
Framed groups	x	x	x	x	x	x	x	x	
Focal context									
Living outside the dikes (frames 1 and 2)	x	x	x	x					
Living in a deep polder (frames 3 and 4)					x	x	x	x	
Communication context									
Highlighting the risks (frames 1 and 3)	x	x			x	x			
Highlighting flood control (frames 2 and 4)			x	x			x	x	
Statement on efficacy									
Yes	x		x		x		x		
No		x		x		x		x	

Table II

Situationally induced prevention- and promotion-focused responses: Mean (*M*), standard deviation (*SD*), and loadings after Varimax rotation.

Items	*M*	*SD*	Components	
			1	2
If I lived in a neighborhood outside the dikes then… /If I lived in a deep polder then… /As inhabitant of this river delta...				
... I would keep in mind that I will have to deal with flood damage sooner or later.	5.02	1.66	.86	.08
... I would make sure that I am well prepared for high water levels.	5.07	1.66	.84	.16
... I would fear that my property value will decrease because of concerns about high water levels.	4.18	1.80	.78	-.16
...I would become very agitated by images of high water levels.	4.14	1.82	.75	-.23
...I would mainly look at all the amenities of the water.	4.45	1.54	-.04	.84
...I think that my house would be very attractive because of the water abundant environment.	4.15	1.50	.18	.82
...I would not think of high water levels as a problem that concerns me.	3.24	1.65	-.22	.57
Eigenvalue			2.70	1.83

Explained variance (%)	38.6	26.2
Cronbach's alpha	.83	.65

Notes: n= 1,887. Scores: 1 = does not apply to me at all, 7 = applies to me completely.

Table III

Positive and negative affect: Mean (*M*), standard deviation (*SD*), and loadings after Promax rotation.

Items	*M*	*SD*	Components	
			1	2
The idea of living in a neighborhood outside the embanked area /The idea of living in a neighborhood in a deep polder /The idea of living in this river delta				
Gives me a pleasant feeling	3.69	1.47	.94	-.03
Gives me a happy feeling	3.69	1.47	.96	.04
Gives me a good feeling	3.75	1.47	.93	-.02
Gives me a cheerful feeling	3.73	1.48	.94	.00
Gives me an anxious feeling	3.73	1.70	-.04	.91
Gives me a worried feeling	4.08	1.65	.04	.94
Gives me an unsafe feeling	3.90	1.69	-.03	.92
Gives me a restless feeling	3.91	1.71	.02	.94
Eigenvalue			4.32	4.22
Explained variance (%)			64.4	23.3
Cronbach's alpha			.96	.95

Notes: n= 1,887. Scores: 1 = absolutely not, 7 = very strongly.

Table IV

Trust in competent risk management: Mean (*M*), standard deviation (*SD*), and loadings.

Items	*M*	*SD*	Loading
To what extent do you trust that authorities such as municipalities and water boards will be able to			
Manage the flood risks in neighborhoods outside the dikes (in a deep polder/ in this river delta) in the next 20 years?	4.05	1.45	.90
Make accurate predictions about flood levels in neighborhoods outside the dikes?	4.17	1.46	.87
Design and plan neighborhoods outside the dikes so that there will little or no damage to the homes and possessions of citizens?	3.95	1.41	.88
Give timely warnings to citizens in neighborhoods outside the dikes, so they can move their car or take other protective measures?	4.33	1.48	.85
Ensure that it will be safe for you (and your family) to live in a neighborhood outside the dikes?	4.18	1.42	.91
Eigenvalue			3.89
Explained variance (%)			77.8
Cronbach's alpha			.93

Notes: n = 1,887. Scores: 1 = no trust at all, 7 = complete trust. Loadings from principal component analysis.

Table V

Chronic prevention and promotion orientations: Mean (M), standard deviation (SD), and loadings after Varimax rotation.

Items (female version)	M	SD	Components	
			1	2
A safe environment is important for her; she prefers to avoid everything that is risky.	4.55	1.54	.80	-.05
She prefers to be insured; she feels uncomfortable about being without insurance.	5.12	1.49	.76	.15
Financial security is important for her; she prefers fixed energy prices and a fixed mortgage interest rate.	5.07	1.46	.71	.07
She has a healthy respect for the water; she feels that warnings of water-related hazards should be taken seriously.	5.30	1.38	.68	.25
She is able to handle setbacks very well; she remains optimistic about a positive outcome.	4.67	1.39	-.03	.68
She is drawn to the water; she feels that living near the water is attractive.	4.35	1.70	-.02	.67
Having a good place to live is important for her; especially a place with a view.	4.92	1.38	.30	.59
She is a fanatic when she is trying to reach her goal; it is important for her to be successful.	3.99	1.52	.13	.58

She enjoys the company of the people in her neighborhood; she becomes easily enthusiastic about doing something together.	3.90	1.56	.14	.56
Eigenvalue			2.32	2.00
Explained variance (%)			30.8	17.4
Cronbach's alpha			.74	.62

Notes: *n* = 1,887. Participants were asked to compare the portrait to themselves and to rate on a 7-point scale ''how much like you" the person is. Scores: 1= not like me at all, 7= very much like me.

Table VI

Skepticism about the seriousness of climate change and awareness of local climate impacts: Mean (*M*), standard deviation (*SD*), and loadings after Promax rotation.

Items	*M*	*SD*	Components	
			1	2
I am optimistic and expect that sea level rise due to climate change will not be more than 10 centimeters during the next 20 years.	4.06	1.45	.94	.20
The seriousness of climate change has been exaggerated.	3.77	1.56	.80	.02
I am pessimistic and expect that sea level rise due to climate change will be more than 10 centimeters during the next 20 years.	3.75	1.48	-.65	.32
Due to climate change and flood risks, the value of the dwellings outside the dikes will decrease in the future.	4.40	1.30	.04	.79
Because of climate change harbor areas outside the dikes will be flooded more frequently and at greater depth.	4.39	1.23	-.16	.73
By improving spatial planning in cities like Rotterdam and Dordrecht, they can counter the impacts of climate change.	4.10	1.41	.16	.71
Eigenvalue			2.18	2.02
Explained variance (%)			41.9	21.2
Cronbach's alpha			.74	.68

Notes: n= 1,887. Scores: 1 = completely disagree, 7= completely agree.

Table VII

Evaluations of the precautions by the control group and by the participants framed to live in a deep polder or outside the dikes.

Precaution	Evaluation criteria													
	Effectiveness for safety		Effectiveness for mitigation		Efficiency for flood control		Troublesome to do (reversed)		Not necessary (reversed)		Hard to judge (reversed)		Intention to apply	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Emergency kit														
Control group	3.87	1.71	2.88	1.66	2.92	1.74	4.85	1.71	4.20	1.86	4.86	1.74	3.80	1.89
Framed groups	4.29	1.79	3.32	1.85	3.20	1.87	4.67	1.79	4.97	1.70	4.76	1.74	4.92	1.73
Difference	.42**		.44**		.28*		-.18		.77***		-.10		1.12***	
In a deep polder	4.33	1.83	3.22	1.84	3.01	1.84	4.64	1.78	5.05	1.66	4.80	1.75	4.89	1.74
Outside the dikes	4.25	1.75	3.41	1.85	3.40	1.88	4.69	1.81	4.88	1.74	4.72	1.73	4.96	1.72
Difference	-.08		.19*		.39***		.05		-.17*		-.08		.07	
Water level information														
Control group	4.81	1.68	4.42	1.70	3.59	1.79	4.45	1.75	5.00	1.51	4.39	1.63	4.32	1.85
Framed groups	5.32	1.42	5.13	1.51	4.29	1.91	4.29	1.79	5.62	1.48	4.38	1.69	5.67	1.43

Difference	.51***			.71***			.70***			-.16			.62***			-.01			1.35***	
In a deep polder	5.28	1.45		4.95	1.58		4.00	1.90		4.30	1.77		5.50	1.52		4.50	1.71		5.52	1.51
Outside the dikes	5.36	1.40		5.31	1.41		4.59	1.87		4.27	1.82		5.75	1.43		4.26	1.86		5.81	1.32
Difference	.08			.36***			.59***			-.03			.25***			-.24**			.29***	
<u>Buying sandbags</u>																				
Control group	3.84	1.80		4.27	1.76		3.75	1.73		3.78	1.91		4.56	1.87		4.46	1.76		3.45	1.98
Framed groups	4.33	1.68		4.69	1.60		4.17	1.75		3.70	1.83		5.33	1.58		4.56	1.77		4.90	1.72
Difference	.49***			.42**			.42**			-.08			.77***			.10			1.45***	
In a deep polder	4.12	1.77		4.54	1.68		3.87	1.78		3.81	1.81		5.16	1.62		4.61	1.79		4.71	1.78
Outside the dikes	4.55	1.57		4.85	1.51		4.48	1.65		3.59	1.84		5.49	1.52		4.51	1.74		5.09	1.64
Difference	.43***			.31***			.61***			-.22*			.33***			-.10			.38***	
<u>Tiling the floor</u>																				
Control group	3.40	2.02		4.63	1.80		3.24	1.92		4.16	2.20		4.31	1.92		4.86	1.88		3.47	2.12
Framed groups	3.79	2.01		5.33	1.53		3.79	2.07		4.31	2.04		5.16	1.54		4.85	1.72		5.11	1.77
Difference	.39**			.70***			.55***			.15			.85***			-.01			1.64***	
In a deep polder	3.73	2.04		5.24	1.56		3.37	1.99		4.33	2.03		4.98	1.56		4.82	1.73		4.94	1.80
Outside the dikes	3.86	1.98		5.42	1.49		4.20	2.05		4.29	2.05		5.34	1.52		4.87	1.72		5.27	1.72

Difference	.13	.18*	.83***	-.04	.36***	.05	.33***

*$p < .05$. **$p < .01$. ***$p < .001$.

Note: The 7-point scales ranged from 1 (completely disagree) to 7 (completely agree). The numbers of subjects were 205 (control group), 1682 (framed groups), 845 (in a deep polder) and 837 (outside the dikes).

Table VIII

Differences between the clusters for the clustering variables: Means per cluster.

	Cluster1 (all low) (n = 392)	Cluster 2 (no sandbags) (n = 447)	Cluster 3 (no kit) (n = 465)	Cluster 4 (all high) (n = 378)	Total (n = 1682)	
Cluster size (in %)	23%	27%	28%	22%	100%	
Clustering variables						
Emergency kit	3.01_a	4.54_b	3.52_c	5.61_d	4.14	F = 638, p < .001
Water level information	4.09_a	5.14_b	5.32_c	6.30_d	5.21	F = 479, p < .001
Buying sandbags	3.43_a	3.96_b	5.31_c	6.07_d	4.68	F = 910, p < .001
Tiling the floor	3.43_a	4.98_b	4.31_c	5.88_d	4.63	F = 494, p < .001

Notes: Means with different subscript letter differ significantly (p < .05)

Table IX

Differences between the clusters for the experimental conditions and the subject variables: Percentages and means per cluster.

	Cluster1 (all low) (n = 392)	Cluster 2 (no sandbags) (n = 447)	Cluster 3 (no kit) (n = 465)	Cluster 4 (all high) (n = 378)	Total (n = 1682)	
Experimental conditions						
% in outside the dikes condition (vs. in deep polder)	$40\%_{a}$	$46\%_{b}$	$54\%_{c}$	$59\%_{c}$	50%	$Chi^2 = 34.86$, $p < .001$
% in highlighted risks condition (vs. flood control)	$48\%_{a}$	$49\%_{a}$	$49\%_{a}$	$58\%_{b}$	51%	$Chi^2 = 9.88$, $p < .05$
% in efficacy statement condition (vs. no	$49\%_{a,b}$	$45\%_{b}$	$47\%_{b}$	$55\%_{a}$	49%	$Chi^2 = 9.39$, $p < .05$

statement)						
Subject variables						
% female	44%	50%	48%	52%	48%	Chi^2 = 5.26, p > .05
% older than 55 years	$29\%_a$	$42\%_b$	$32\%_a$	$53\%_c$	39%	Chi^2 = 69.25, p < .001
% with higher education	$42\%_a$	$30\%_b$	$44\%_a$	$24\%_c$	35%	Chi^2 = 57.47, p < .001
Situationally induced prevention	$-.32_a$	$.19_b$	$.25_b$	$.53_c$	.16	F = 70.42, p < .001
Situationally induced promotion	-.08	-.06	.03	.05	-.02	F = 1.46, p > .05
Chronic prevention	$-.47_a$	$.03_b$	$.06_b$	$.60_c$	.05	F = 86.63, p < .001
Chronic promotion	$-.15_a$	$.03_b$	$-.03_{a,b}$	$.18_{b,c}$	.00	F = 7.46, p < .001
Negative affect	$-.17_a$	$.20_{b,c}$	$.12_b$	$.35_c$	.13	F = 20.79, p < .001
Positive affect	-.13	-.07	-.04	-.08	-.08	F = .66, p > .05

Trust in competent risk management	-.17$_{a}$	-.10$_{a,b}$	-.07$_{a,b}$	.04$_{b}$	-.08	F = 3.10, p < .05
Skepticism about climate change	.07	-.00	-.02	-.12	-.02	F = 2.40, p > .05
Awareness of local climate impacts	-.39$_{a}$	.05$_{b}$	.05$_{b}$	.37$_{c}$	.02	F = 41.50, p < .001

Notes: Percentages and means with different subscript letter differ significantly (p < .05). Means and standard deviations of the variables are presented in Table X.

Table X

Correlations between and means and SDs of the variables (framed groups only, n = 1682).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Emergency kit	–															
2. Water level information	.44***	–														
3. Buying sandbags	.41***	.46***	–													
4. Tiling the floor	.44***	.46***	.41***	–												
5. Situationally induced prevention	.19***	.35***	.27***	.26***	–											
6. Situationally induced promotion	-.01	.04	.06*	.06*	.00	–										
7. Chronic prevention	.26***	.40***	.25***	.29***	.40***	-.12***	–									
8. Chronic promotion	.11***	.10***	.06*	.08**	-.04	.30***	-.02	–								
9. Negative affect	.15***	.16***	.13***	.16***	.47***	-.41***	.34***	-.22***	–							
10. Positive affect	-.01	-.01	.08**	.04	-.10***	.53***	-.14***	.30***	-.44***	–						
11. Trust in competent risk management	.04	.08**	.09***	.09***	-.09***	.40***	-.08**	.25***	-.35***	.43***	–					
12. Skepticism about climate change	-.12***	-.06*	-.05*	-.04	-.14***	.16***	-.13***	.09***	-.20***	.10***	.19***	–				
13. Awareness of local climate impacts	.26***	.27***	.19***	.21***	.26***	-.11***	.32***	.11***	.26***	-.12***	-.10***	-.34***	–			
14. Gender (female)	.06*	.06*	.03	.03	.05	-.06*	.04	-.02	.10***	-.06*	-.03	-.02	-.00	–		

15. Age	.13***	.18***	.04	.20***	-.04	.00	.16***	-.01	-.02	-.06*	.02	.07**	.08**	-.10***	–	
16. Level of education	-.16***	-.08**	-.07**	-.18***	.04	.02	-.14***	.02	-.04	-.03	.01	-.05*	.00	-.02	-.28***	–
Mean	4.14	5.21	4.68	4.63	.16	-.02	.05	.00	.13	-.08	-.08	-.02	.02	1.48	49.8	2.21
SD	1.32	1.11	1.30	1.26	.88	1.00	.99	.99	.95	.98	.99	1.00	.99	.50	13.1	.91

*$p < .05$. **$p < .01$. ***$p < .001$.

APPENDIX

Introduction (all participants)

The Netherlands is a water-rich country, where people have been living near major rivers (like the Rhine and Meuse) for a long time, both inside and outside the embanked area.

Before presenting the questions, participants in the control group were reminded of the purpose of the questionnaire as follows:

In this study, we are interested in your opinion about living in the river delta.

Before presenting the questions, participants in the four experimental conditions were introduced to one the four risk frames that was randomly assigned to them.

Text for frame 1 and 2 (floor flooding outside the dikes)

Many old harbor areas that are located outside the embanked area are no longer in use. This is why local governments would like to redevelop these areas into new residential neighborhoods. In the future, these neighborhoods will remain unprotected by dikes. Although these areas outside the embanked area are often elevated, future residents should take flooding into account, which potentially causes damage. In this study, we are interested in your opinion about living in such a neighborhood outside the dikes.

If you would live in such a neighborhood outside the dikes in the future, then it is important to know that you may experience floods. Especially the combined effect of large amounts of water in the rivers and a storm surge of seawater (during a Northwestern wind) may cause high water levels in the delta. This hazard has decreased because of the Maeslant (storm surge) Barrier, but has not been completely eliminated.

During times of high water levels streets can be covered with water. Such high water levels occur on average once in 10 years.

Text and photos for frame 1 only (highlighting the risks)

Floods are of all times and usually cause serious damage. Moreover, the climate is changing, which increases the amount of water in rivers and causes sea level rise. According to experts, the Netherlands is insufficiently protected against the consequences of climate change. As a result, the flood risks in neighborhoods outside the dikes may increase in the future.

Photos for frame 1 (presented without caption)

Text and photos for frame 2 only (highlighting flood control)

In the Netherlands we have already known for a very long time that water entails risks. The first dikes have been constructed more than 1000 years ago. Moreover, the government is continuously working on flood safety. Recently, a new Delta Committee has advised how the Netherlands can be protected against the water, also in the far future (until the year 2100).

Photos for frame 2 (presented without caption)

Final text for frame 1 and 2 (floor flooding outside the dikes)

Finally, participants in these two experimental conditions were reminded of the purpose of the questionnaire:

In this study, we would like to know how you think about living in such a neighborhood outside the dikes. Imagine that you would live in such a neighborhood outside the dikes, close to the river.

Text for frame 3 and 4 (flooding in a deep polder)

Local governments are always searching for locations to build new neighborhoods. As a result, it becomes more and more common to build houses in deep polders, near the river dikes. A depth of 5 or 6 meters below the water level of a river is not uncommon. Although these polders are protected by dikes, there is no guarantee that flooding will not occur. In this study, we are interested in your opinion about living in such a deep polder.

If you would live in such a deep polder in the future, then it is important to know that you may experience floods. Especially the combined effect of large amounts of water in the rivers and a storm surge of seawater (during a Northwestern wind) may cause high water levels in the delta. This hazard has decreased because of the Maeslant (storm surge) Barrier, but has not been completely eliminated. Dikes can breach if water levels in the river are very high. Such high water levels occur on average once in 2000 years. But, a dangerous situation can also arise if water levels are lower. That is because not all dikes are exactly equally strong. Even though the probability is low, the water level in the polder after a dike breach can rise up to 2 to 3 meters high.

Text and photos for frame 3 only (highlighting the risks)

Floods are of all times and usually cause serious damage. Moreover, the climate is changing, which increases the amount of water in rivers and causes sea level rise. According to experts, the Netherlands is insufficiently protected against the consequences of climate change. As a result, the flood risks in deep polders may increase in the future.

Photos for frame 3 (presented without caption)

Text and photos for frame 4 only (highlighting flood control)

In the Netherlands we have already known for a very long time that water entails risks. The first dikes have been constructed more than 1000 years ago. Moreover, the government is continuously working on flood safety. Recently, a new Delta Committee

has advised how the Netherlands can be protected against the water, also in the far future (until the year 2100).

Photos for frame 4 (presented without caption)

Final text for frame 3 and 4 (deep polder)

Finally, participants in these two experimental conditions were reminded of the purpose of the questionnaire:

In this study, we would like to know how you think about living in such a deep polder.

Imagine that you would live in a deep polder, close to the river.